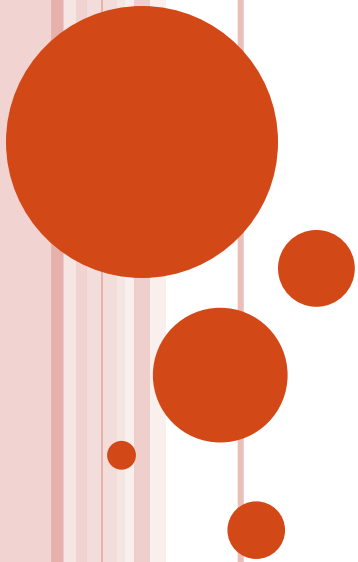


INTRODUCTION TO SMART SENSORS & ITS' APPLICATION



CONTENTS

- *Introduction*
- *What is Smart Sensors?*
- *Usefulness of Si technology in Smart Sensors*
- *Why smart sensor?*
- *Components of smart sensor*
- *General architecture of Smart Sensors*
- *Evolutions of Smart Sensors*
- *Advantages*
- *Application of Smart Sensors*
- *Industrial application area of Smart Sensors*
- *Disadvantages*

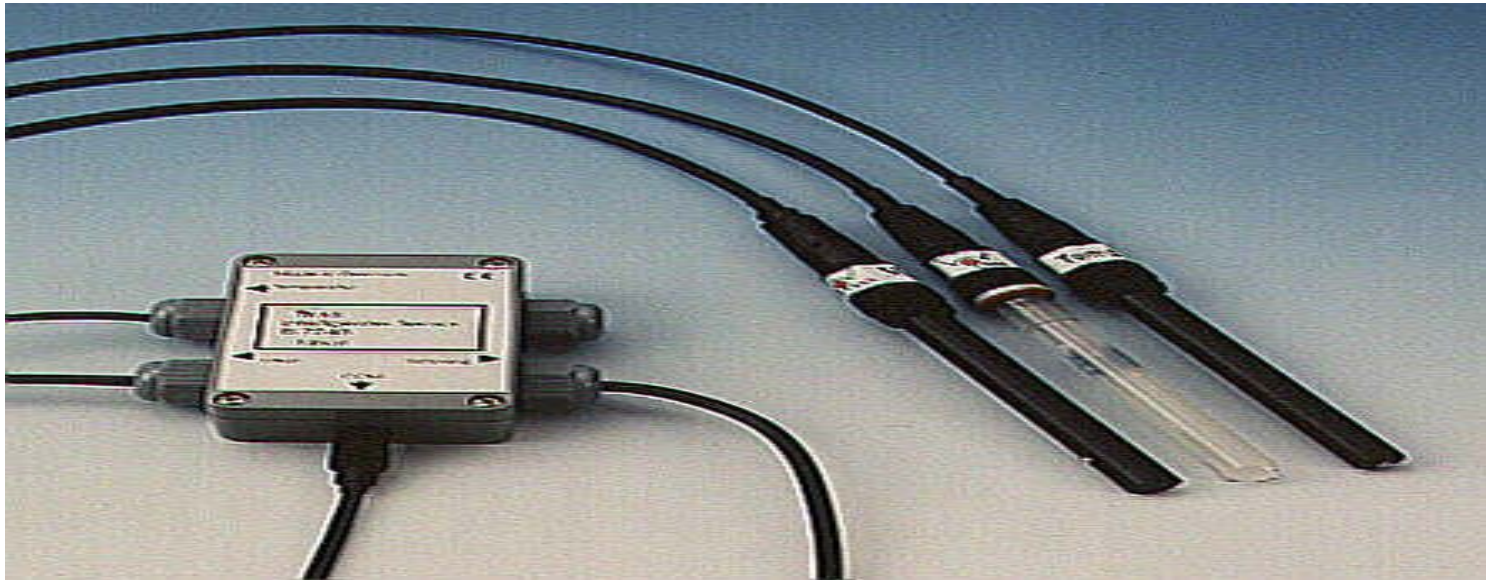


INTRODUCTION

- *sensors are capable of manipulation and computation of the sensor-derived data*
- *Sensor + interfacing circuit = smart sensor*
- *Capable of*
 - * logic functions,*
 - * two-way communication,*
 - * make decisions.*



WHAT IS SMART SENSORS



- *A sensor producing an electrical output when combined with interfacing electronic circuits is known as "Smart Sensor", it is a combination of both sensor and actuator.*
- *It simply physical, biological or chemical input & converts it to the measured value into a digital format.*



USEFULNESS OF SILICON TECHNOLOGY IN SMART SENSORS

- ❖ *Single chip solution*
- ❖ *Very small in size*
- ❖ *Less space in configuration*
- ❖ *Work with small signals*



WHY SMART SENSORS?

Smart sensor enhances the following applications:

- **Self calibration:** *Adjust deviation of o/p of sensor from desired value.*
- **Communication:** *Broadcast information about its own status.*
- **Computation:** *Allows one to obtain the average, variance and standard deviation for the set of measurements.*
- **Multisensing:** *A single smart sensor can measure pressure, temperature, humidity, gas flow and infrared, chemical reaction surface acoustic vapour etc.*
- **Cost effective:** *less hardware and reduction of repetitive testing make smart sensor cost effective.*



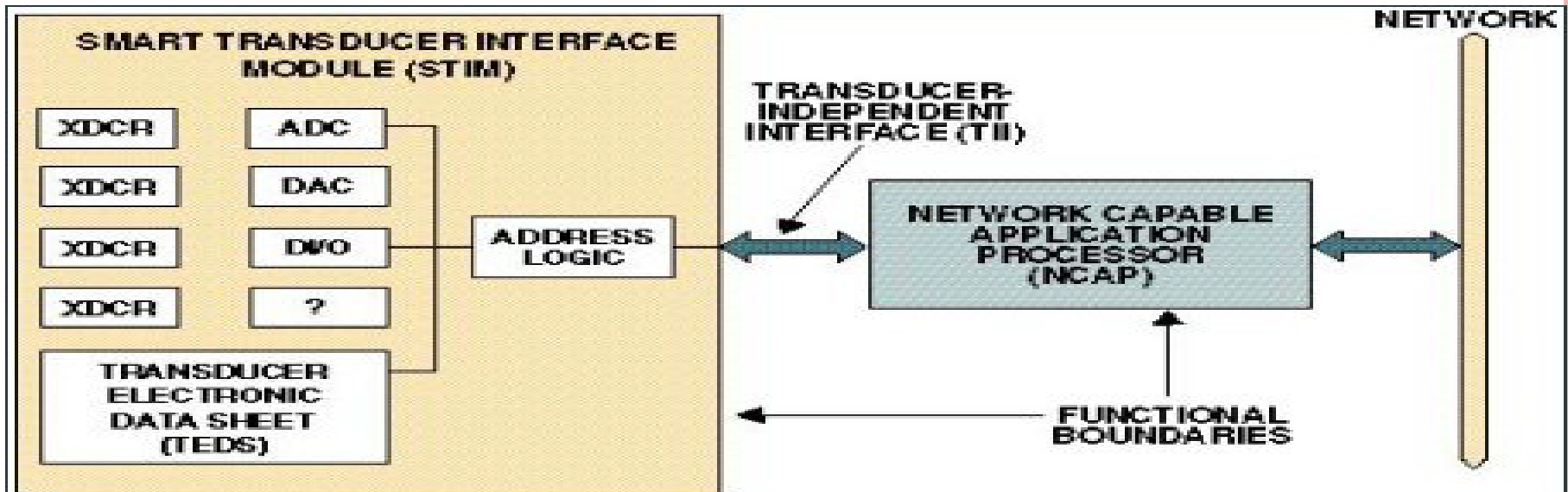
COMPONENTS OF SMART SENSORS

I. Network Capable Application Processor (NCAP)

- Communications
- Interface Control
- Message Routing
- TIM Discovery and Control
- Data Correction Interpretation of TEDS Data
- Message Encoding and Decoding

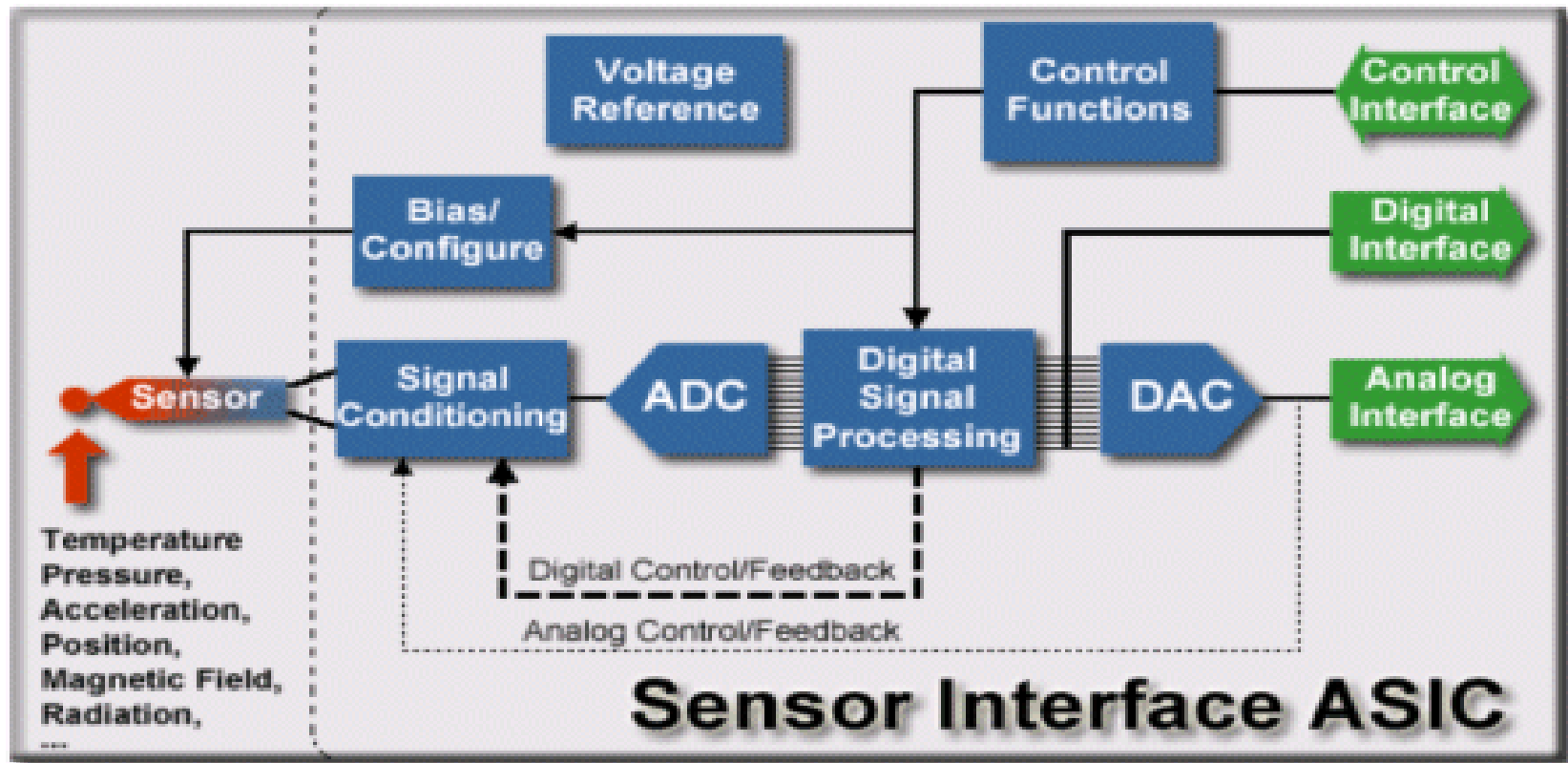
II. Transducer Interface Module (TIM)

- TEDS Storage
- Analog Signal Conditioning
- Triggering
- Analog to Digital Conversion
- Command Processing
- Data Transfer
- Communications



GENERAL ARCHITECTURE OF SMART SENSORS

The generalized architecture of smart sensor is shown below:

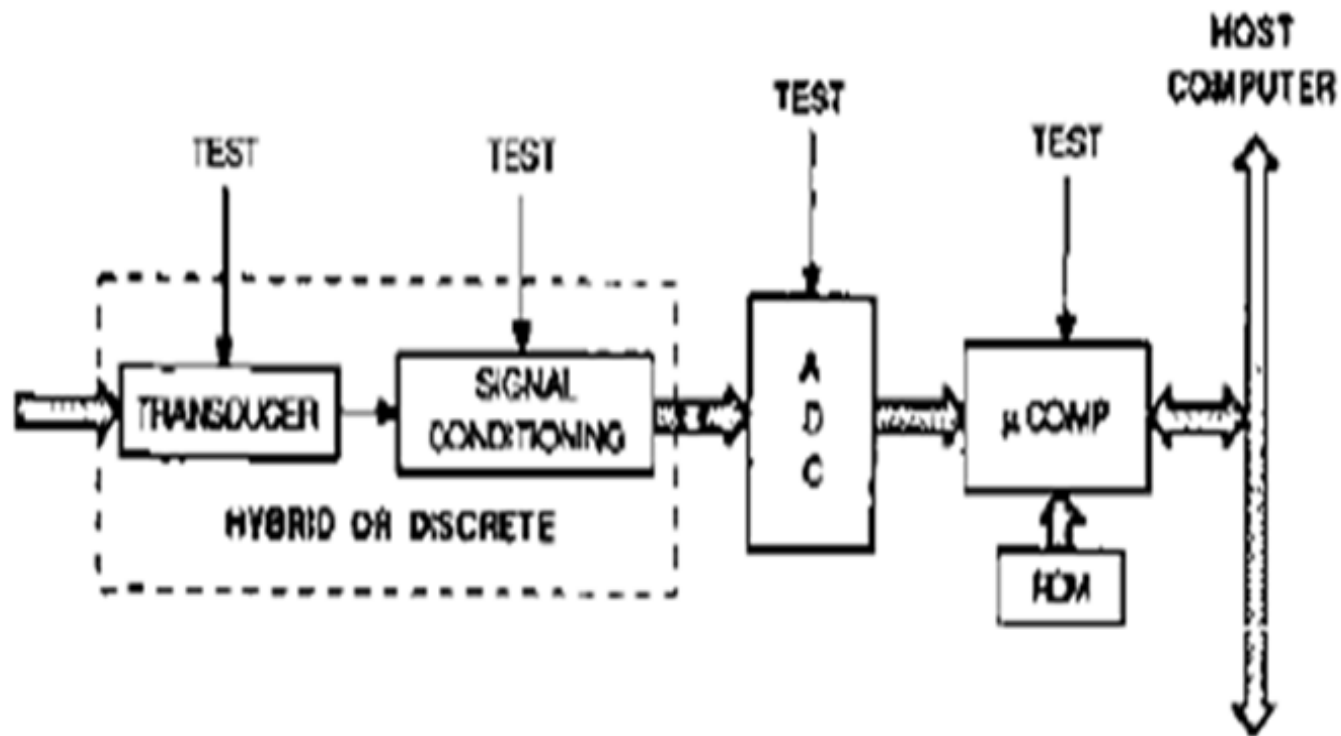


EVOLUTION OF SMART SENSORS

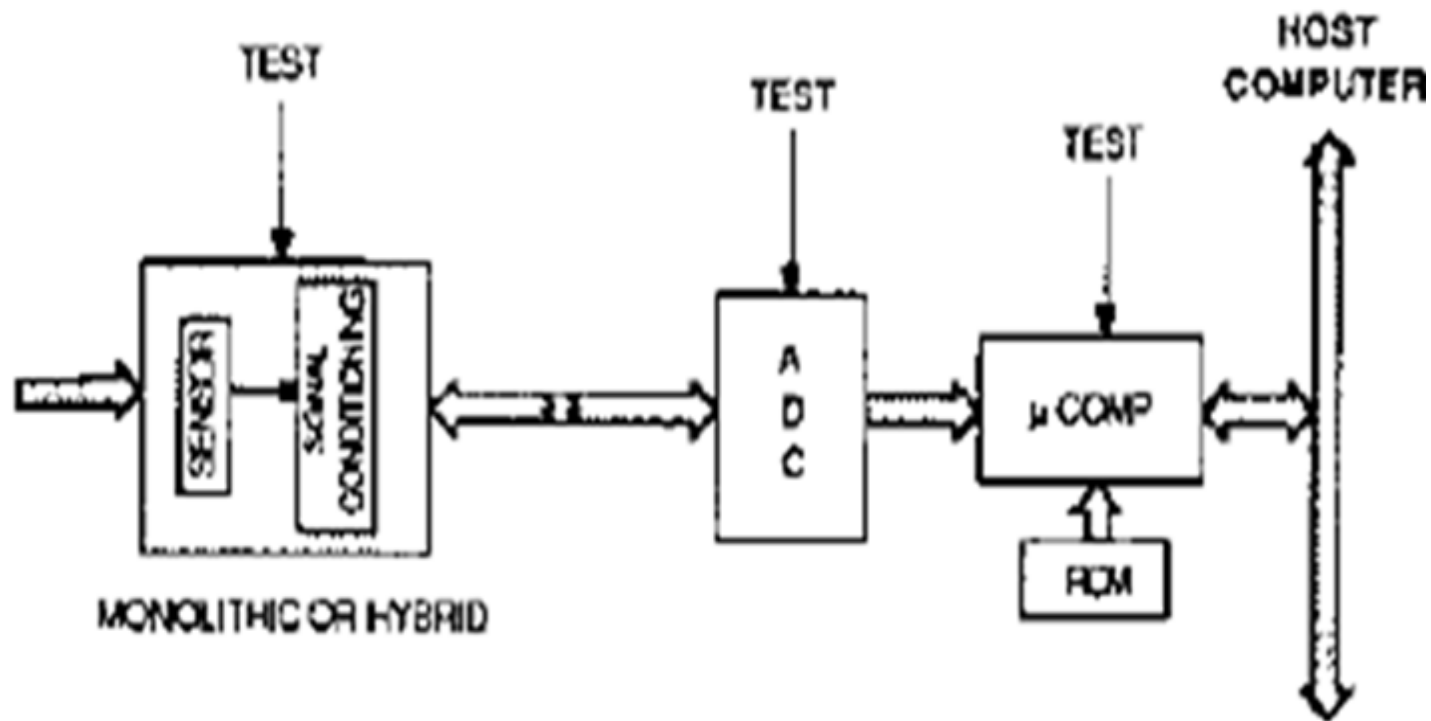
- *First generation devices had little, if any, electronics associated with them.*
- *Second-generation sensors were part of purely analog systems with virtually all of the electronics remote from the sensor.*



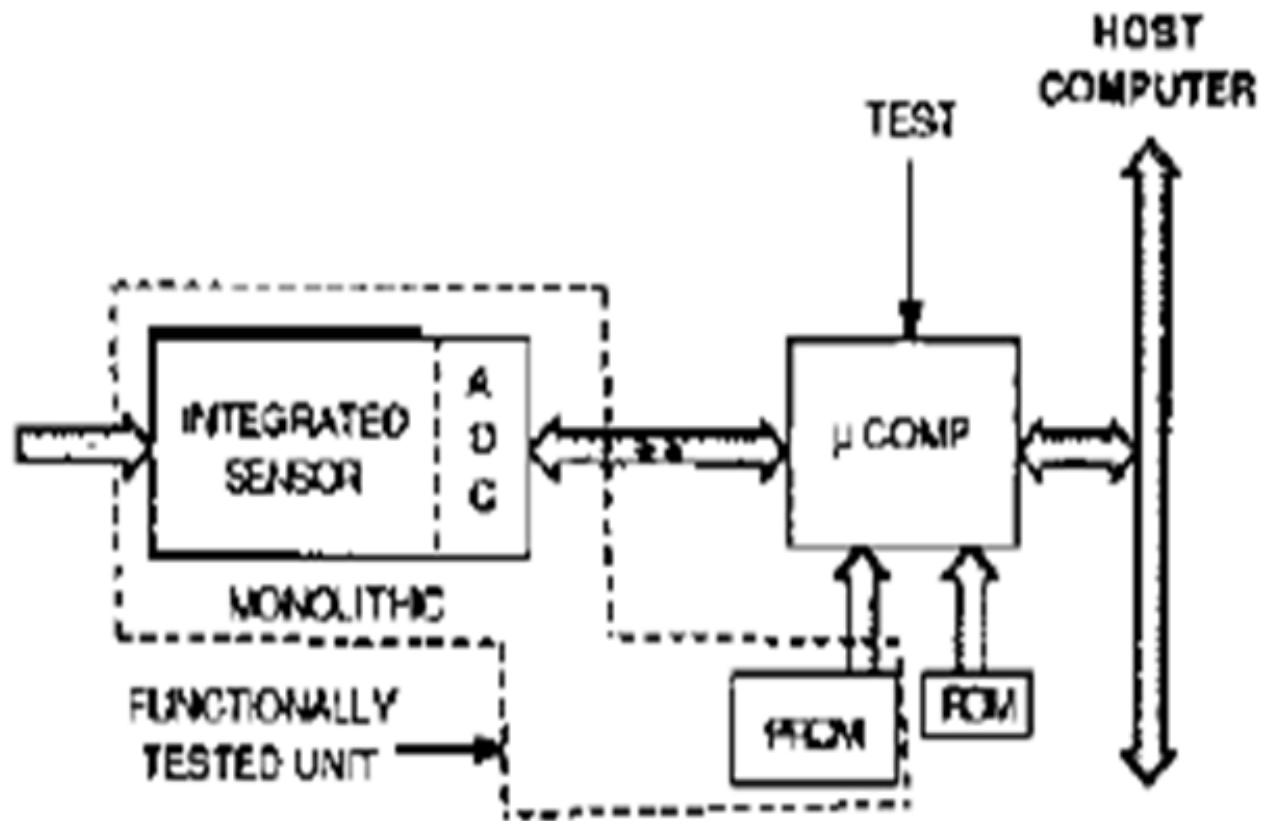
3RD GENERATION SMART SENSOR



4TH GENERATION SMART SENSOR



5TH GENERATION SMART SENSOR



ADVANTAGES

- i. Minimum Interconnecting Cables*
- ii. High Reliability*
- iii. High Performance*
- iv. Easy to Design, Use and Maintain*
- v. Scalable -Flexible System*
- vi. Small Rugged Packaging*
- vii. Minimum Cost*



APPLICATIONS OF SMART SENSORS

➤ Accelerometer:

- *It consists of the sensing element and electronics on silicon. The accelerometer itself is a metal-coated SiO₂ cantilever beam that is fabricated on silicon chip where the capacitance between the beam and the substrate provides the output signal.*



APPLICATIONS

- **Optical sensor:**
 - *Optical sensor is one of the examples of smart sensor, which are used for measuring exposure in cameras, optical angle encoders and optical arrays. Similar examples are load cells silicon based pressure sensors.*



APPLICATIONS

- **Infrared detector array:**
 - *It is developed at solid laboratory of university of Michigan. Here infrared sensing element is developed using polysilicon.*



APPLICATIONS

- *Integrated multisensor:*
 - *This chip contains MOS devices for signal conditioning with on chip sensor. it is developed in university of California.*



INDUSTRIAL APPLICATION AREA OF SMART SENSORS

❖ *Structural monitoring:*

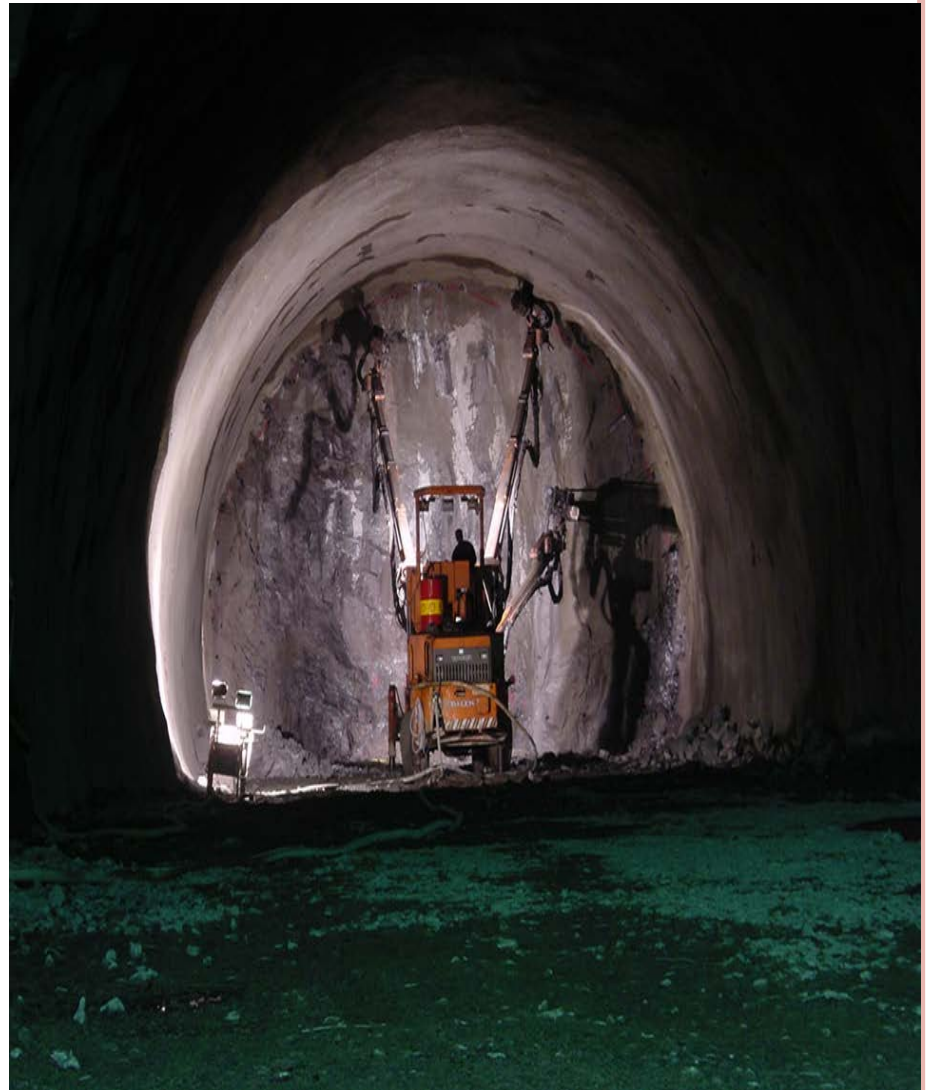


- *It is needed to detect damages of industrial infrastructure.*

INDUSTRIAL APPLICATIONS

❖ Geological mapping:

- *It is needed mainly to detect the minerals on the geological areas.*
- *Digital imaging & interpretation of tunnel geology.*
- *Remote measurements of tunnel response.*



DISADVANTAGES

- *The smart sensor consists of both actuators & sensors, so it is more complex than other simple sensors.*
- *The complexity is much higher in the wired smart sensors, as a consequence the costs are also higher.*

